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SEVENTH MONTHLY PROGRESS REPORT ON DEVELOPMENT AND TESTING OF ELECTROLYTE MATRIX COMBINATIONS FOR MERCURY-POTASSIUM FUEL CELL

(12 JUNE—12 JULY 1963)

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OTS

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OTS PRICE
XEROX $ 1.40
MICROFICHE $ 0.50

Allison Division
General Motors Corporation
Indianapolis, Indiana

(NASA CR-53348)
EDR-3476

PROGRESS OF WORK DURING THIS REPORTING PERIOD

Effort for this period was concentrated on improvement of the electrolyte composite fabrication techniques. A 34% composite electrolyte was tested in the small cell rig. The work originally scheduled for this period was delayed because of the amount of time required for the composite work. The Time-Phased diagram shown in Figure 1 of the Fifth Monthly Progress Report (Allison EDR 3360), therefore, is not significantly changed. A revised diagram will be available for the program status meeting to be held next month. The Second Quarterly Progress Report was written and issued.

Composite Improvement Program

The following improvements were made in composite fabrication.

1. An argon flooding cabinet was built to handle all steps in the composite fabrication procedure which were previously performed in air. This is done to eliminate water and CO_2 from the mixture.

2. Holders were built for each specimen, using 1/4-in. plexiglass sheets separated and sealed by rubber O-rings. These holders were tested and proved gas tight. The composite specimens can now be safely stored for long periods. They can also be X-rayed or photographed without removal from the holders.

3. A batch of 34% electrolyte composite was reprocessed to remove moisture and improve homogeneity and purity. Specimens from this reprocessing foamed and bloated excessively during the final argon bake and examination disclosed that a grinding procedure had introduced magnetic particles. This foaming and bloating was eliminated in new specimens made of the same material after the magnetic particles had been removed.

Small Cell Testing

A 2-in. x 1/8-in. disk was prepared from the reprocessed 34% electrolyte composite. This disk was used as an electrolyte matrix in the small cell rig.

The rig was modified prior to testing incorporating an electrolyte reservoir in the K metal feed line. This is to ensure that the K metal is saturated with electrolyte before it contacts the composite. The need for this precaution was determined and reported earlier in compatibility studies.

The cell showed the characteristic voltage, greater than one volt, when potassium was introduced. Mercury was present only in the preheater at this time. The voltage dropped rapidly under a 120 ma load. Then intermittent shorting occurred and reduced the voltage to near zero.

The addition of Hg caused the cell potential to rise to near 1 volt, but intermittent shorting persisted. Before the Hg cavity was filled the cell shorted to zero voltage with an increase in temperature. This shows that a direct electrode mixing occurred at the time of matrix rupture.

Posttest analysis showed that the matrix deformed either under its own weight in the horizontal position or under the initial potassium head in the vertical position. Indication is that the matrix is weak and needs support. The seal region of the composite held up well.

Composite Fabrication

Three new batches of fine grain composite were prepared—50/50, 60/40, and 70/30 electrolyte/MgO ratios. The overall range of electrolyte MgO ratios is being looked at again in consideration of the recent preparation techniques. Testing will continue into the next report period.

WORK FOR NEXT REPORTING PERIOD

Work for the next period will emphasize the testing of newly prepared composites in both compatibility studies and small cell tests. Also, greater effort will be made to complete strength optimization for the fine grain composite.

CUMULATIVE MAN MONTHS EXPENDED

RESEARCH	19.7
SHOP	0.6
MATERIALS LABORATORY	14.0

BUDGET

RESEARCH	30 Man Months
SHOP	2 Man Months
MATERIALS LABORATORY	17 Man Months